Gems and Precious Stones

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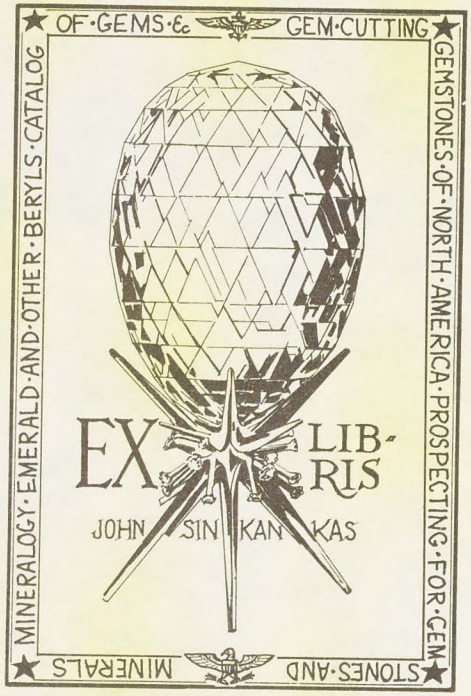
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Gems and Precious Stones

A Tabular Arrangement of Their Characteristics and Localities

with some

Tests and Literature on the Subject

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CONTENTS

Characteristics and Localities

of the

Principal Precious Stones

by

LEOPOLD CLAREMONT.

Supplement to
THE JEWELERS' CIRCULAR,
February 5, 1902.

Characteristics and Localities

Name of Gem.	*Chemical Composition.*	*System of Crystallography.*	*Common Form.*	*Cleavage.*	*Fracture.*	*Luster.*	H.	S.G.
DIAMOND.	Carbon 100	Cubic.	Octahedron and Dodecahedron.	Parallel to faces of Octahedron, highly perfect.	Conchoidal.	Brilliantly Adamantine.	10	3.52
RUBY.	Alumina .....98.5 Oxide of Iron..... 1.0 Lime 5	Hexagonal.	Hexagonal Prism and Pyramid.	Basal and Rhombohedral.	Conchoidal or uneven.	Vitreous, very lively.	8.5 to 9	3.9 to 4.2
SAPPHIRE.	"	"	"	"	"	"	9	"
ORIENTAL EMERALD. (Green Sapphire).	"	"	"	"	"	"	"	"
ORIENTAL TOPAZ. (Yellow Sapphire).	"	"	"	"	"	"	"	"
ORIENTAL AMETHYST (Purple Sapphire).	"	"	"	"	"	"	"	"
ASTERIA OR STAR-STONE.	"	"	"	"	"	"	"	"
FANCY SAPPHIRE.	"	"	"	"	"	"	"	"
SPINEL.	Alumina ..... 72 Magnesia 28	Cubic.	Octahedron and Rhombic Dodecahedron.	Parallel to faces of Octahedron, highly perfect.	Sub-conchoidal.	Vitreous.	8	3.5 to 3.6

H. = Hardness. S.G. = Specific Gravity.

of the Principal Precious Stones.

Color.	*Diaphaneity.*	*Index of Refraction.*	*Refraction.*	*Pleochroism.*	*Electric Properties.*	*Fusibility, etc.*	*Principal Localities.*	*Mode of Occurrence.*	*Noteworthy Characteristics.*
Colorless, Yellow, Red, Blue, Brown, Pink, Green, and Black.	Transparent.	2.439	Single.	M.	Exhibits positive electricity when rubbed.	If heated to a very high temperature, burns in air and oxygen.	India, Brazil, S. Africa, Australia.	In Quartzose Conglomerate.	Crystal, often with curved faces and frequently twinned.
All shades of Red.	"	1.794	Double in slight degree.	D.	Electricity acquired by friction, and retained several hours.	Infusible: Dissolves to clear bead with borax and microcosmic salt, etc.	Burma, Siam, Ceylon, Pegu.	Frequently in Gravels of Rivers and Torrents.	Often found in water-worn Pebbles.
All shades of Blue.	"	"	"	"	"	"	Pegu, Montana, Australia.	"	"
Green.	"	"	"	"	"	"	Ceylon, Pegu.	"	"
Yellow.	"	"	"	"	"	"	"	"	"
Purple.	"	"	"	"	"	"	"	"	"
Red, Blue, and Grey.	"	"	"	"	"	"	Burma, Ceylon.	"	" asteroid.
Pale shades of all Colors.	"	"	"	"	"	"	Ceylon, Montana, Australia.	"	Water-worn Pebbles.
Red, Blue, Green, Pink, Orange, Brown, also Black.	Transparent to Opaque.	1.755 to 1.809	Single.	M.	Positively electric in polished state.	Almost infusible: with borax difficulty fusible.	Ceylon, Siam, Pegu.	Occurs in Granular Limestone, Gneiss, and Volcanic Rocks.	Crystals frequently twinned.

M. = Monochroic. **D.** = Dichroic. **T.** = Trichroic.

Name of Gem.	*Chemical Composition.*	*System of Crystallography.*	*Common Form.*	*Cleavage.*	*Fracture.*	*Luster.*	H.	S.G.
TOPAZ.	Silica .....16.2 Fluoride of Silicum..28.1 Alumina 55.7	Rhombic.	Rhombic Prism.	Parallel to Basal Plane, and highly perfect.	Sub-conchoidal to uneven.	Vitreous.	8	3.4 to 3.6
TOURMALINE.	Silica combined with Oxide of Iron, Magnesium, Manganese, and Aluminium, and Boron in different proportions. Very variable.	Hexagonal.	Hexagonal and Triangular Prisms.	Rhombohedral difficult.	Sub-conchoidal or uneven.	"	7 to 7.5	2.9 to 3.3
GARNET.	Silica .....36 Alumina .....21 Oxide of Iron.....33 Oxide of Manganese.. 2 Magnesia ..... 4 Zinc ..... 2 Very variable.	Cubic.	Rhombic-dodecahedron.	Parallel to the faces of the Dodecahedron.	"	"	6.5 to 7.5	3.15 to 4.3
PERIDOT OR OLIVINE.	Silica .....40.16 Alumina ..... 0.10 Magnesia .....44.37 Protoxide of Iron..15.38	Rhombic.	Right Rectangular Prism modified.	Prismatic.	Imperfectly conchoidal.	"	6—7	3.3 to 3.5
CHRYSOLITE.	"	"	"	"	"	"	"	"
EMERALD.	Silica .....66.8 Alumina .....19.1 Glucina 14.1	Hexagonal.	Hexagonal Prism.	Parallel to Basal Plane indistinct.	Conchoidal or uneven.	Vitreous or resinous.	7.5 to 8	2.63 to 2.75
BERYL OR AQUAMARINE.	"	"	"	"	"	"	"	"
PHENAKITE.	Silica .....54.2 Glucina 45.8	"	Low Obtuse Rhombohedron.	Parallel to faces of Rhombohedron, indistinct.	Conchoidal.	Vitreous.	7.5	2.966 to 2.99
EUCLASE.	Silica .....43.22 Alumina .....30.56 Peroxide of Iron.... 2.22 Glucina .....21.78 Oxide of Tin..... 0.70	Monoclinic.	Oblique Prism with lateral edges beveled, and variously terminated.	Parallel to faces of the Prism.	"	"	"	3.03 to 3.09

H. = Hardness. S.G. = Specific Gravity.

Color.	*Diaphaneity.*	*Index of Refraction.*	*Refraction.*	*Pleochroism.*	*Electric Properties.*	*Fusibility, etc.*	*Principal Localities.*	*Mode of Occurrence.*	*Noteworthy Characteristics.*
Colorless, Yellow, Brown, Blue, Pink.	Transparent to Sub-translucent.	1.635	Double in slight degree.	D.	Electricity acquired by friction and heat.	Infusible: if heated with nitrate of cobalt, and reheated, turns blue.	Brazil, Pegu, Siberia, Saxony.	Frequently embedded in Quartz.	Crystals sometimes doubly terminated, striated longitudinally.
Red, Blue, Green, Brown, Yellow, and Black.	Transparent to Opaque.	1.625	Double.	"	Positive and negative electricity acquired by friction and heat.	Fusible with great difficulty or only upon surface.	Siberia, Ceylon, Ava.	In Granite, Gneiss, Mica-slate, Chlorite-slate, and Granular Limestone.	Sometimes Green internally and Red externally, also *vice versa*
All shades of Red and Brown. Green.	"	1.815	Single.	M.	Electricty acquired by friction and heat.	Fusible with ease.	Brazil, India, Ceylon.	In Alluvial Deposits, and in Gneiss, Mica-schist, etc.	Crystals often perfect in shape, also occurs Granular.
Chartreuse Green.	"	1.660	Double.	D.	Electricity acquired by friction.	Infusible, with borax fuses to a transparent glass.	Levant, Egypt.	Frequently in boulders of Basalt.	Very seldom in perfect Crystals.
Primrose Yellow.	"	"	"	"	"	"	"	"	"
"Emerald" Green.	"	1.585	Double in very slight degree.	"	Positive electricity acquired by friction.	Edges of splinters become rounded by great heat.	India, S. America, Siberia.	In Limestone.	Frequently Parti-colored.
Colorless, Blue, Green, Yellow.	"	"	"	"	"	"	"	"	"
Colorless and Pale Yellow.	"	1.62	Double.	"	Positively electric in polished state.	Alone infusible: with borax slowly forms a clear glass.	Peru.	In Mica-schist.	Easily mistaken for Diamond when cut.
Bluish Green.	"	"	"	T.	Rendered electric by pressure.	Becomes opaque under great heat.	Peru, Brazil, The Urals.	Frequently in Chlorite-slate.	Very brittle.

M. = Monochroic. D. = Dienroic. T. = Trichroic.

Name of Gem.	*Chemical Composition.*	*System of Crystallography.*	*Common Form.*	*Cleavage.*	*Fracture.*	*Luster.*	H.	S.G.
ZIRCON OR JARGOON.	Silica .....33 Zirconia 67	Tetragonal.	Tetragonal Prism.	Parallel to faces of Prism, indistinct; to Pyramid, still less distinct.	Conchoidal.	Adamantine.	7.5	4.7
JACINTH.	"	"	"	"	"	"	"	"
CHRYSOBERYL.	Alumina .....80.2 Glucina 19.8	Rhombic.	Modified Rectangular Prism.	Distinct Parallel to Brachydome; less distinct Parallel to Brachypinakoid.	"	Vitreous.	8.5	3.5 to 3.8
ALEXANDRITE.	"	"	"	"	"	"	"	"
CATSEYE.	"	"	"	"	"	"	"	"
SPODUMENE.	Silica .....66.14 Alumina .....27.02 Peroxide of Iron... 0.32 Lithia ..... 3.84 Soda 2.68	Monoclinic.	Oblique Rhombic Prism.	Very perfect Parallel to the Orthopinakoid.	Uneven.	Pearly, but vitreous on cross-fractured surfaces.	6.5 to 7	3.2
HIDDENITE.	"	"	"	"	"	"	"	3
Kunzite.	"	"	"	"	"	"	"	"
AMETHYST.	Silica 100	Hexagonal.	Hexagonal Prism and Pyramid.	None, or only very indistinct traces occasionally procured with much difficulty.	Conchoidal.	Vitreous, occasionally resinous.	7	2.5 to 2.8
CAIRNGORM.	"	"	"	"	"	"	"	"
IOLITE.	Silica .....48.33 Alumina .....31.71 Magnesia .....10.16 Protoxide of Iron.. 8.32 Protoxide of Manganese ..... 0.34 Water 0.58	Rhombic.	Short Hexagonal Prism.	Brachy-diagonal.	Uneven to conchoidal.	Vitreous.	7 to 7.5	2.6 to 2.7

H. = Hardness. S.G. = Specific Gravity.

Color.	*Diaphaneity.*	*Index of Refraction.*	*Refraction.*	*Pleochroism.*	*Electric Properties.*	*Fusibility, etc.*	*Principal Localities.*	*Mode of Occurrence.*	*Noteworthy Characteristics.*
Brown, Yellow, Green.	Transparent to Opaque.	1.961	Double in very slight degree.	D.	Positively electric when polished.	Infusible: becomes white when heated.	Ceylon, New South Wales.	In Syenite and Crystalline Limestone, Gneiss, Chlorite-schist, etc., also in Alluvial Deposits.	Crystals frequently doubly terminated.
Cinnamon Color.	"	"	"	"	"	"	"	"	"
Yellow, Brown, Sage Green.	"	1.760	Double.	"	—	Infusible alone: with borax or microcosmic salt difficulty.	Ceylon, Brazil, The Urals.	In association with Zircons, Sapphires, etc.	Crystals frequently compound, giving rise to six-sided and stellate forms.
"	"	"	"	"	—	"	"	"	Changes Color.
"	"	"	"	"	—	"	"	"	Chatoyant.
Primrose Yellow, Greenish Yellow.	"	1.67	"	"	Electric in the polished state.	Easily fusible to greyish transparent glass.	Brazil, Tyrol, Massachusetts.	With Magnetic Iron Ore, Quartz, and Tourmaline.	Usually very fragmentary.
Grass Green.	"	"	"	"	"	"	N. Carolina.	"	"
Peach.	"	"	"	"	"	"	California.	"	"
Purple.	"	1.549	"	"	"	Infusible: dissolves if heated with carbonate of soda.	India, Spain, Siberia.	Found in all Igneous Rocks.	Under Polariscope sections cut at right angles to Optic Axis exhibit Circular Polarization.
Brown, Yellow.	"	"	"	"	"	"	Common in all countries.	"	"
Smoky Bluish Grey.	"	1.57	"	"	"	Fused with difficulty at edges.	Spain, Bavaria, Ceylon.	Embedded in Granite, also in Quartz.	Often found in water-worn Pebbles.

M. = Monochroic. D. = Dichroic. T. = Trichroic.

Name of Gem.	*Chemical Composition.*	*System of Crystallography.*	*Common Form.*	*Cleavage.*	*Fracture.*	*Luster.*	H.	S.G.
MOONSTONE.	Silica .....65.69 Alumina .....17.97 Potash .....13.99 Lime ..... 1.34 Soda 1.01	Monoclinic.	Thick Oblique Rectangular Prisms.	Massive, or in extremely complicated forms.	Conchoidal to uneven and splintery.	Vitreous to pearly on Cleavage.	6	2.39 to 2.62
EPIDOTE.	Silica .....36.14 Alumina .....22.24 Peroxide of Iron...14.29 Lime .....22.86 Magnesia ..... 2.38 Protoxide of Manganese ..... 2.12 Variable.	"	Oblique Rhombic and Rectangular Prisms.	Perfect Orthodiagonal.	Uneven.	Vitreous. Pearly on Cleavage planes.	6—7	3.2 to 3.5
AXINITE.	Silicate of Lime, Alumina, Sesqui-oxides of Iron, Manganese, with a little Boracic Acid and Magnesia.	Triclinic.	Thin and very sharp Crystals.	Distinct Parallel to Brachypinakoid.	Small and imperfect.	Highly vitreous.	6.5 to 7	3.27
SPHENE OR TITANITE.	Silica .....30.35 Titanic Acid.....33.43 Lime 21.33	Monoclinic.	Oblique Rhombic Prism.	Easy Parallel to the faces of the Prism.	Imperfect conchoidal.	Adamantine or resinous.	5 to 5.5	3.4 to 3.56
DIOPSIDE.	Silica .....47.63 Lime .....20.87 Magnesia .....12.9 Alumina ..... 6.74 Protoxide of Iron..11.39 Protoxide of Manganese ..... 0.20 Water 0.29	"	"	Parallel with Planes of Oblique Rhombic Prism.	Uneven.	Vitreous, inclining to resinous.	5—6	3.2 to 3.5
TURQUOISE.	Alumina .....47.45 Phosphoric Acid....27.34 Oxide of Copper.... 1.10 Peroxide of Manganese ..... 0.50 Phosphate of Lime 3.42 Water 18.17	Amorphus.	—	—	Small conchoidal.	Rather waxy; internally dull.	6	2.6 to 2.8
PRECIOUS OPAL.	Hydrous Silica.	"	—	—	Conchoidal.	Subvitreous.	5.5 to 6.5	2.21

H. = Hardness. S.G. = Specific Gravity.

Color.	*Diaphaneity.*	*Index of Refraction.*	*Refraction.*	*Pleochroism.*	*Electric Properties.*	*Fusibility, etc.*	*Principal Localities.*	*Mode of Occurrence.*	*Noteworthy Characteristics.*
Colorless and Bluish White.	Transparent to Opaque.	1.55	Double slight.	D.	Electric in the polished state.	Fuses only on the edges.	Ceylon.	In Granite Rocks.	Often twinned, exhibits peculiar Sheen or Blush.
Green, Yellow Grey, Red, and Black.	"	1.7	Double.	"	"	Fuses more or less easily according to amount of iron or manganese.	Urals, Greenland, Norway.	In Igneous Rocks and in various Crystalline Slates.	Crystals usually much elongated on the Orthodiagonal Axis.
Purplish Blue, Brown, and Grey.	Transparent to Translucent.	1.68	"	T.	Becomes electric by heat and friction.	Fuses readily.	Norway.	Occurs in Igneous Rocks.	Soluble in Hydrofluoric Acid.
Golden Yellow to Brown.	"	1.88	"	D.	Electric in polished state.	Infusible, but some varieties change color under great heat.	St. Gothard, Norway, United States.	In Granite, Gneiss, Micaschist, also in Volcanic Rocks.	Crystals often twinned. Sometimes occurs Massive.
Greenish White to Greyish Green.	"	1.66	"	"	"	Fuses to a colorless glass.	Piedmont.	Occurs in Basalt and other Volcanic Rocks.	Crystals generally striated longitudinally.
Sky Blue.	Opaque to Semi-Opaque.	—	—	—	—	Infusible.	Persia, Egypt, N. America.	Probably resulted from the alteration of Apatite.	Occurs reniform stalactitic, and incrusting.
Almost Colorless (Iridescent).	Transparent.	1.05	Single.	—	—	Infusible: becomes opaque with heat.	Queensland, N. S. Wales, Hungary, Mexico.	In Ferruginous Sandstone.	Displays internal Reflections and Opalescence.

M. = Monochroic. D. = Dichroic. T. = Trichroic.

Tests for Precious Stones

by

E. HOPKINS.

From

THE JEWELERS' CIRCULAR—WEEKLY.

September 12, 1906.

Tests for Precious Stones.

THERE is an old saying that "All the good die young," but the modern version in the jewelry trade should be, that all the good come to life when old, speaking geologically of sparkling gems. The list accompanying this has been compiled with the idea of giving in a concrete form a ready system of reference of *some* of the tests for precious stones, and is a reduction of a larger one mounted on card and measuring 19½ x 15 inches.

At first sight, perhaps, the list appears to contain a formidable number of names and details, but upon examination it will be found to be simple enough. Color, being the most obvious character of a stone, is taken as an index. Thus, if we have, say, a pink stone, it is only necessary to examine the five species in the list possessing that color. Many names are necessarily repeated on account of the numerous varieties of color. For instance, tourmaline is mentioned no fewer than seven and sapphire six times, and so on. A few very rare colors are not included, but the tests in such cases are, of course, precisely the same.

Any doubtful specimen which would be encountered in the ordinary course of business will always be found under one of the headings of the list. Considerable confusion might be caused by reference to the textbooks, since not only do the trade and mineralogists often give different names to the same species or variety, but they even, in one case at least, apply a particular name to entirely distinct species. Thus peridot is termed by mineralogists olivine or chrysolite; and, on the other hand, olivine (green garnet) is known to them as andradite or demantoid. It is hoped that the criteria accompanying this article will remove any doubt that may arise.

The tests, and apparatus required for them, are as follows: (1) Dichroism, (2) Density or Specific Gravity, (3) Hardness; and (4) Refractive Power. By such means all gems can be discriminated. Of course, there are other tests, but they have either restricted application or require elaborate and expensive apparatus.

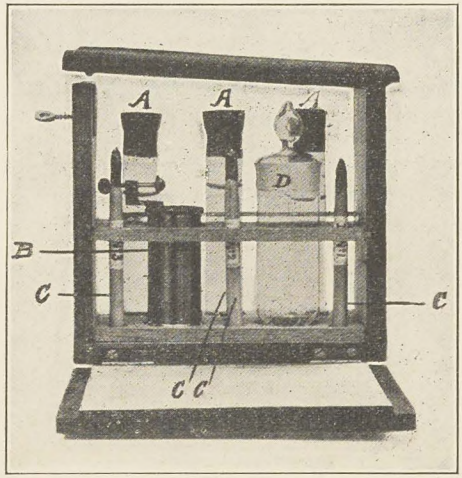


FIG. 1, SHOWING CASE AND CONTENTS.

To test the dichroism, we require an inexpensive little instrument about two inches long, known as the dichroscope. It is very useful for *many* colored stones and will generally give the result in a few seconds.

The necessary apparatus for the determination of the specific gravity consists of three or six tubes containing liquids of different densities, so that, by placing the stone to be experimented upon in one or more of them, its specific gravity can be obtained, and, by comparison with the list, can be recognized. An extra and larger tube is also supplied to take stones up to about 50 carats each.

Four points of varying hardness are cemented into holders and are of use in confirming the other tests. Nos. 1, 2, 3 are supplied in a mahogany case as in illustration.

The refractometer recently introduced by G. F. Herbert Smith, M.A., measures on a photographic scale an equivalent to the refractive index, if not exceeding 1.76, and so, as will be seen, covers a large number of precious stones; the remainder, being separated from these, can be specified to some extent *negatively*. There is also no

calculation required with this instrument. The refractive indices correspond to the several divisions of the scale.

These four tests form a very rapid and correct means of classifying gems.

A powerful magnifying glass should always be at hand with which many characteristics can be seen that would be otherwise overlooked. The watchmakers' eyeglass with double lenses gives very good results.

It would be of great advantage if some of the technical institutes could give a course of lectures or classes—advertising them well—on "Gemmology"—a word, I believe, introduced by W. J. Lewis Abbott when he gave a series of excellent lectures some few years ago—at the same time developing the optical side a little more. I would suggest the reading of Dr. Max Bauer's book on "Precious Stones," which has been translated by L. J. Spencer, M.A., from the German edition. It is a somewhat bulky volume, but is full of interesting matter, with a great number of colored and other plates, and, I believe, is the finest of its kind that has been published. The values placed in some parts of the book are hardly in accordance with trade ideas, but otherwise the information is excellent and very clear. For a small handbook for ready reference there is nothing to equal Professor Church's "Precious Stones," either in price or information. The latter should be in the hands of all who have anything to do with the subject. The last (1905) edition has been much enlarged. A series of visits to the Museum of Practical Geology, Jermyn-street, and the British Museum (Natural History) at South Kensington, would surprise many on account of the exceedingly fine display of specimens and admirable arrangement of cases. In the latter museum this is especially so. The window cases on the left give a good introduction to the study of minerals.

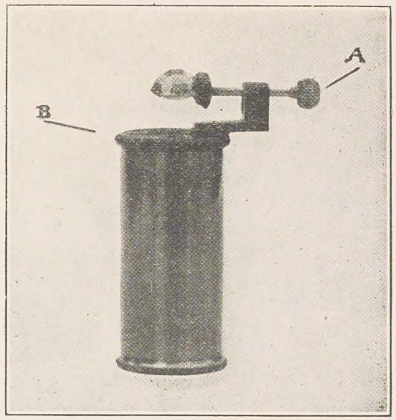


FIG. 2, THE DICHROSCOPE.

THE DICHROSCOPE.

Method of Use.—In the case of those instruments having the additional fitting, the stone is slightly warmed to give a better grip in the wax, and focussed by sliding the end piece B. By means of the button A, it may be given a circular motion in one direction, and if the inner tube B is revolved, another circular movement is received at right angles, so that the stone can be examined in many directions. Failing the extra fitting, the stone is taken in the usual manner and held in front of the small square hole at one end. Light passing to the eye through the instrument is split up into two beams, and a double image of the square opening is produced. When these images, on interposition of the stone, are of different *tints,* the stone is said to be dichroic—two colored—(see list under D). The instrument is a good test only for stones having *strong* or *distinct* dichroism, providing they have a fair amount of color. With those in the list marked "faint" it is not very serviceable, as the comparison is often difficult to see. Those stones which in *all* positions show both squares the same tint are said to be "monochroic," *i.e.,* of one color. The latter consist of only three groups, and are easily remembered: the diamond, the spinel, and the garnet. The latter include not only the ordinary garnets, but also the jeweler's jacinth and the jeweler's olivine. (The latter was formerly known as green garnet.) All the others are dichroic, some faintly so, while

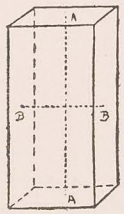


FIG. 4.

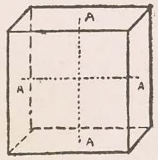


FIG. 3.

others are very distinct. (See list.) The darker the color, the better the result, providing light can pass through the stone. The monochroic stones all crystalize in one group, the cubic, the simplest form of

which is the cube, having imaginary axes at right angles, and of equal length, AA. All non-crystaline materials are also monochroic. The remainder crystalize in various classes, and have axes of differing lengths, caused by certain molecular grouping, which gives the property of dichroism. Fig. 4 shows such axes. AA is known as the *optic axis,* and may be either longer or shorter than BB, but is always of different length. (For our present purpose we will ignore those having two optic axes.) Along the direction AA only the same tint will be seen, but the dichroic effect becomes more and more pronounced until BB is reached, when it is at its strongest. In a cut stone the positions can only be found by looking at the specimen from different points of view. Some easy tests are:

	Dichroic.	*Monochroic.*
Emerald	.....	from jeweler's olivine.
Sapphire & blue tourmaline	"	spinel and garnet.
Fancy colored sapphire..	"	fancy colored spinel.

THE SPECIFIC GRAVITY TUBES.

In this test, liquids of different specific gravity are supplied in three, as illustrated (Fig. 1), and also in six glass tubes. The stones must, of course, be unmounted specimens.

Each tube is marked with the density of the contained liquid, as compared with distilled water, and numbered 1, 2, 3, 4, 5, and 6, respectively. For instance, the liquid in No. 1 is between 4.0 and 4.7, and therefore is more than four times the weight of an equal amount of distilled water. In each of the tubes are two small fragments of different minerals—"indicators"—which are to be kept in their respective tubes. With the case having three tubes of liquid, divide most of the methylene iodide into three portions, putting rather more in No. 4 than in No. 5, and a little less in No. 6. No. 4 is to be left pure. Nos. 5 and 6 are to have their densities reduced by adding benzine, drop by drop, until the indicators are in position—one at the top, and the other at the bottom of the liquid. It is very important to see that they are so, as the benzine after a time evaporates.

The liquid must also be mixed thoroughly by the glass rod, as the benzine, being lighter, is apt to remain at the top. Should, by accident, too much benzine be put in, add some more methylene iodide from No. 4, or permit the benzine to evaporate. The figures on the labels present the specific gravity of the liquid, i.e., between those of the contained fragments. The density of No. 4 can be increased, if desired, by adding iodoform, but the liquid then becomes cloudy. It should be noted that benzine is highly inflammable. Valuable turquoises should not be risked in this or other liquids, the stone being porous.

To show the use of these, let us take for example *colorless* stones:

Quartz (rock crystal) floats in No. 6.
Aquamarine .....floats in No. 5 and sinks in No. 6
Tourmaline ..... " " 4 " " " 5
Diamond ..... " " 3 " " " 4
Brazilian topaz... " " 2 " " " 3
Sapphire ..... " " 1 " " " 2
Jargoon sinks in No. 1.

In the same manner, of course, colored stones can be classified. The color in certain varieties varies slightly with the density. These are given in the list. This test is an additional one to the dichroscope; as, for example, between a blue tourmaline and a sapphire of the same color, it would be somewhat difficult positively to separate the two with the latter alone. The three tubes, Nos. 4, 5, and 6, which are available for the determination of densities not exceeding 3.3, are especially recommended as entailing scarcely any trouble, and being a very ready test. The other three are somewhat more troublesome and more expensive.

If, instead of the tubes Nos. 1, 2 and 3, the ordinary diamond scales are used (which I think preferable, for the denser varieties weighing more than one carat each), the following is the method, the fractions are converted into decimals:

1-2 carat = .500 1-16 carat = .062
1-4 carat = .250 1-32 carat = .031
1-8 carat = .125 1-64 carat = .015

Take the weight in air of a stone, say,
2 1-4 carats = 2.250
Then the weight in water, say, 1 17-32
carats = 1.531

Difference .719

Divide the weight in air by the difference and the specific gravity 3.129 will be found.

```
.719) 2,250 (3.129
      2.157
      -----
       .930
       719
       ---
       2110
       1438
       ----
        672
```

Toluene, the specific gravity of which is .869, is better than distilled water, since its surface tension is much less, the relation being then,

$$\frac{\text{weight in air} \times .869}{\text{difference between weight in air and Toluene}} = \text{sp. gr.}$$

The illustration will give the general ar-

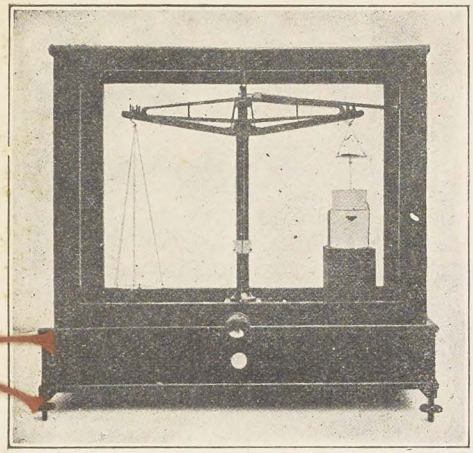


FIG. 5.

rangement of the scales, the stone being freed from all air bubbles on the surface and suspended by a thin platinum wire in the liquid. It is better, but not absolutely necessary, to have an additional pan made. The same amount of platinum wire should be *in* the liquid when adjusting the balance as when weighing the stone, *i.e.*, the pan should be lifted the same height in both cases. The usual temperature of a room is sufficient for ordinary results. Toluene should be kept in a stoppered bottle as it will otherwise rust all steel parts if kept in the same case.

THE TEST OF HARDNESS.

This is useful where the hardness is *distinctly* different, and may be used as *confirming* the results obtained otherwise.

The four fragments are fixed in short holders, see illustration Fig. 1 with tubes and dichroscope, and consist of (according to Mohs' scale):

Diamond representing	10
Sapphire representing	9
Topaz representing	8
Quartz (rock crystal)	7

The diamond would naturally scratch anything softer than that represented by 10, the sapphire would mark the spinel and topaz and so on in each case. If the experiment be on a faceted stone, it should be tried on one of the bottom facets, on the corner at the back, as near as possible to the edge without chipping.

In this way a scratch will scarcely be noticed, and will not cause much injury. This test should never be applied on the front without the owner's permission. When the points become blunt, move the position by warming the cement and bringing a fresh cutting edge to the top. As there is not sufficient space in the list, it may be mentioned here, that Siberian, Auvergne (which is sometimes called by jewelers "oriental"), Uruguay and Scotch amethysts are all of the same material—quartz.

THE HERBERT SMITH REFRACTOMETER.

This has been recently introduced, and is a very portable and convenient instrument to employ in place of the former heavy and very expensive apparatus. It is preferably used with the yellow sodium flame, while the ordinary incandescent electric light, or the yellow gas are better than daylight. In the latter the line on the scale is not quite so distinct, although giving fair readings. A drop of a certain liquid is

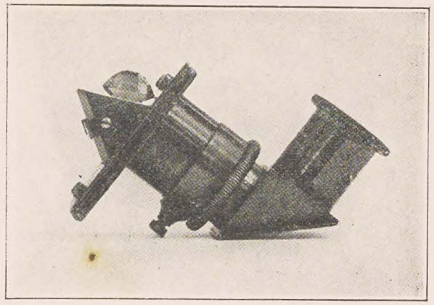


FIG. 6.

placed between the stone and the flat surface of the hemispherical glass, the position of the edge of the dark shadow noted on the photographic scale inside, and the reading of this line compared with the graduations given on the card supplied with the instrument, which correspond to the different refractive indices. No calculation whatever is required.

Light traversing the glass hemisphere in the direction AB (Fig. 7) is partly refracted—*i.e.*, bent—on entering the stone along the direction BC, and partly reflected within the glass along the direction BD. If the angle ABY be reduced, it will reach a critical angle, EBY, at which the refracted rays graze the surface separating the stone and the glass. At any smaller angle—for instance, GBY—none of the light passes out into the stone, but the *whole* is reflected along the direction BH. Now the compensating lens (omitted for convenience in Fig. 7) is such that light reflected from the plane surface of the glass hemisphere at whatever angle comes

to focus on the photographic scale UV. The critical rays, as shown in the diagram, are focussed at P. The portion of the scale towards V is illuminated by totally reflected light, and is bright by comparison with the portion towards U, which is illuminated by partially reflected light. The position of P depends on the refractive power of the stone. If the glass of the instrument be hemispherical in shape, the edge of the shadow is slightly curved. In the case of the slightly more expensive refractometer, with semi-cylindrical lens, the edge is straight.

Double refracting stones have the power of dividing the light into two rays. In certain varieties these rays are considerably apart, and there can be seen in some cases as much difference as four units in the second place of decimals, *e.g.,* peridot. Recently there have been some pastes sold as peridots, which were in general appearance the same, and their hardness not very different, but the refractive indices (apart from the wide separation of the double rays of the peridot) are so distinct that no mistake could have been made had the refractometer been employed.

Single refracting stones and all pastes show only one line. During 1904 and 1905 many tourmalines have been found of very unusual colors. Among others, the yellows are rather interesting, and vary from an orange tint, through various shades, to the pale green varieties; also some purple-colored ones resembling spinels in tint are curious. These can be readily tested with this instrument; also the yellow spodumene can be distinguished from chrysolite, and

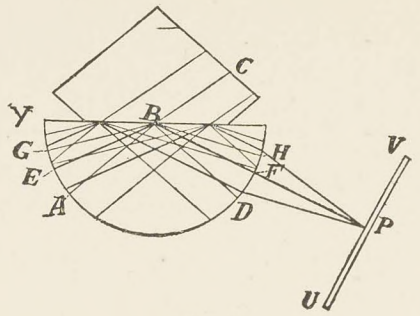


FIG. 7.

the pink variety, kunzite, from pink topaz and tourmaline.

It is also exceedingly useful for most *mounted* stones; the result is not affected if the back of the stone is closed and foiled or even painted.

No damage is done to the stone experimented upon.

In these notes, the names known by jewelers have been applied.

This gives a rough outline of the principle and some uses of this invention, but the pamphlet issued with it by the maker gives much fuller particulars, and is in itself a treatise on much optical phenomena which is worth studying.

The apparatus covers a wide field in registering those transparent gems which have a refractive index not greater than 1.76 and also naturally tests those of higher refractive power by negative means.

Summary.—To sum up roughly the foregoing notes: The dichroscope easily tests those stones having strong or distinct dichroism from monochroic ones, where there is a fair amount of color.

The specific gravity tubes numbered 4, 5, and 6, are useful for both colored and colorless stones up to those having a density of 3.3.

The tubes numbered 1, 2, and 3, are useful for very small stones with greater density than 3.3. The ordinary diamond, or other delicate balance, is employed for taking the specific gravity of stones weighing more than one carat and having a density greater than that of tube No. 4 (3.3) the liquid being either distilled water or toluene.

The Herbert Smith refractometer classifies both colored and colorless gems up to those having a refractive index of 1.76 and negatively for those beyond this, and is besides on *many* occasions useful for those that are *mounted,* whether they are foiled or not. This is one of the most rapid tests.

The points of hardness are used when the difference is considerable to confirm the other results.

After very little practice these can all be applied easily.

The subject of precious stones in general is exceedingly interesting and fascinating, and it must be a matter of great regret to the lecturers of this and kindred subjects that the opportunities held forth are so little appreciated. It would be in every way an advantage if a better general knowledge of the characteristics of gems were prevalent.

Should any of the foregoing notes not be clearly enough expressed the writer will be pleased to answer any correspondence on the subject.

The list has been compiled mostly from information in the following books, and also that kindly supplied by Herbert Smith, M.A. The volumes are: "Precious Stones," by A. H. Church, F.R.S.; paper cover, 1s. 9d. "Precious Stones," by Max Bauer, translated by L. J. Spencer, M.A. "Mineralogy," by H. A. Miers, D.Sc., M.A., F.R.S. "A Text Book of Mineralogy," by E. S. Dana.

Color.	*Jeweler's name.*	*Mineralogical name where different.*	*Specific gravity.*	*Dichroism.*	*Refractive power.*	*Hardness.*	*Easiest tests.*
BLUE Light	**AQUAMARINE**	(Group) BERYL	2.69—2.70	Distinct.	1.576 1.582	7½-8	Floats in No. 5. Sinks in No. 6.
	TOPAZ (Brazil)		3.50—3.60	Distinct.	1.629 1.637	8	Floats in No. 3. Sinks in No. 4.
	EUCLASE		3.05—3.10	Strong.	1.652 1.671	7½	Floats in No. 4. Sinks in No. 5. By S. G.
Dark	**SAPPHIRE**	(Group) CORUNDUM	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1. From Spinel by D., S. G. and H. From tourmaline by S. G. and H. A so-called beryl-sapphire has no D., and is softer than spinel; is also full of bubbles.
	SPINEL		3.60—3.70	None.	1.716 to 1.736	8	Floats in No. 2. Sinks in No. 3. From sapphire and tourmaline by R., S. G., H. and lack of D.
	TOURMALINE	Also INDICOLITE	3—3.2	Strong.	1.637 1.655	7½	Floats in No. 4. Sinks in No. 5. From sapphire by S. G. and H. From spinel by D., S. G. and R.
	Water Sapphire or IOLITE	Also CORDIERITE and DICHROITE	2.60—2.66	Strong.	1.54 1.55	7½	Just floats or sinks in No. 6. By S. G. and R.
	ANATASE		3.82—3.95	Distinct.	2.49 2.55	5½	Just sinks in No. 2.
	KYANITE (also Light Blue)		3.56—3.67	Distinct.	1.71 1.73	5-7	Just floats or sinks in No. 3. Also by R.
Translucent	**TURQUOISE**	Also CALLAITE	2.6—2.8	None.	....	6	Floats in No. 5. Most sink in No. 6. For S. G. must be free from matrix. A so-called manufactured turquoise is much softer and some show minute cracks parallel with edge. Most Egyptian turquoises are more translucent than Persian, which is noticeable on back. Glass imitations are heavier.
	STAINED AGATE		2.6	None.	....	6½	Floats in No. 6. Much harder than turquoise.
	BONE or FOSSIL TURQUOISE	ODONTOLITE	3.0—3.5	None.	....	5	Some float, some sink in No. 4. Hydrochloric acid on surface effervesces. Shows bony structure under magnifier.

Color.	Jeweler's name.	Mineralogical name where different.	Specific gravity.	Dichroism.	Refractive power.	Hardness.	Easiest tests.
GREEN (See also Spinel)	**EMERALD**	(Group) BERYL	2.70—2.71	Strong.	1.576 1.582	7½-8	Floats in No. 5. Sinks in No. 6. From olivine. By D., H., S. G. and R.
	GREEN GARNET OR **OLIVINE**	BOBROWSKA GARNET or DEMANTOID, or ANDRADITE	3.83—3.85	None.	1.880 to 1.890	6	Floats in No. 1. Sinks in No. 2. Lack of D.
	GARNET (CAPE GREEN).	ENSTATITE	3.1—3.13	Weak.	1.665 1.674	5½	Floats in No. 4. Sinks in No. 5. From olivine and emerald, by S. G., H. and R.
	SAPPHIRE	(Group) CORUNDUM	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1. From chrysoberyl, by S. G. Generally a dark green. From spodumene and jargoon, by S. G. and H. Jargoon, by S. G. and H.
	ALEXANDRITE or CHRYSOBERYL	(Group) CHRYSOBERYL	3.68—3.78	Strong.	1.747 1.756	8½	Floats in No. 2. Sinks in No. 3. Also by S. G. Alex. turns red by gaslight. Those that do not change known as chrysoberyls.
	SPODUMENE	(Var.) HIDDENITE	3.17—3.20	Distinct.	1.651 1.677	6½-7	Floats in No. 4. Sinks in No. 5. From Alex., by S. G., H. and R. Very rare.
	JARGOON	ZIRCON	3.98—4.1	Faint.	1.830 1.830	7½	Some just float, some sink slowly in No. 1. By S. G. Some green have only faint double refraction.
	AQUAMARINE	(Group) BERYL	2.69—2.70	Faint.	1.576 1.582	7½-8	Floats in No. 5. Sinks in No. 6. Harder and lighter than peridot. Also by R.
	PERIDOT	OLIVINE, CHRYSOLITE or PERIDOT	3.3—3.5	Faint.	1.647 1.683	6½-7	Floats in No. 3. Sinks in No. 4. Some float in No. 4, but warm hand on tube sinks them. From pastes by R.
	DIOPSIDE		3.20—3.38	Faint.	1.668 1.694 to 1.732 1.750	6	Just floats or sinks in No. 4. From epidote by R.
	OBSIDIAN		2.4	None.	1.505	5-5½	Floats in No. 6. Softer and much lighter than peridot. Also by R. Contains glassy bubbles. Is a natural glass.
	TOURMALINE		3.1	Strong.	1.619 1.637 to 1.637 1.655	7-7½	Floats in No. 4. Sinks in No. 5. Harder and lighter than peridot. Strong D. Also by R.
	EPIDOTE		3.3—3.4	Distinct.	1.727 1.765 to 1.733 1.771	6½	Floats in No. 3. Sinks in No. 4. From tourmaline by S. G. and H.

Color.	*Jeweler's name.*	*Mineralogical name where different.*	*Specific gravity.*	*Dichroism.*	*Refractive power.*	*Hardness.*	*Easiest tests.*	
BROWN	**TOPAZ** (Brazilian)		3.50—3.55	Strong.	1.615 1.625 to 1.629 1.637	8	Floats in No. 3. Sinks in No. 4.	Tour. Ax. Andal, by D.
	JARGOON	ZIRCON	3.98—4.1	Faint.	1.923 1.967 to 1.931 1.993	7½	Some just float, some sink in No. 1. See (image) colorless.	Topaz, by S. G. and D.
	TOURMALINE		3.08	Strong.	1.619 1.637 to 1.637 1.655	7½	Floats in No. 4. Sinks in No. 5.	Tourm. lighter than Ax.
	SPINEL		3.60—3.70	None	1.716 to 1.736	8	Floats in No. 2. Sinks in No. 3.	Spinel. Lack of D.
	IDOCRASE	Also VESUVIANITE	3.45	Distinct.	1.719 1.719 to 1.723 1.723	6½	Floats in No. 3. Sinks in No. 4.	
	AXINITE		3.29—3.30	Distinct.	1.675 1.685	6½-7	Just floats or sinks in No. 4.	
	ANDALUSITE		3.18	Strong.	1.632 1.643	7½	Floats in No. 4. Sinks in No. 5.	From Ax., by S. G. and R.
	JACINTH	HESSONITE or CINNAMON STONE, (group) GARNET	3.55—3.65	None.	1.744 to 1.748	7½	Floats in No. 2. Sinks in No. 3.	Jacinth and garnet, by S. G.
	GARNET		3.7—3.8	None.	1.740 to 1.770	7½	Just floats or sinks in No. 2.	From Spinel, by R.
	CAIRNGORM	(Group) QUARTZ	2.65	Faint.	1.544 1.553	7	Floats in No. 6.	Cairngorm from Mex. opal, by S. G., R. and H.
	MEXICAN OPAL		2.1—2.2	None.	1.450	5½-6½	Floats in No. 6.	
PINK	**RUBY or SAPPHIRE**	(Gp.) CORUNDUM.	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. By H. and S. G. A few sink slowly in No. 1. A pink sapphire is practically a pale ruby.	
	BALAS RUBY or **SPINEL**		3.60—3.63	None.	1.716 to 1.730	8	Floats in No. 2. Sinks in No. 3. Lack of D. Also by R.	
	TOPAZ (Braz.)		3.54—3.56	Strong.	1.615 1.625 to 1.629 1.637	8	Floats in No. 3. Sinks in No. 4. H., S. G. and R.	
	TOURMALINE	(Var.) RUBELLITE.	3.02	Strong.	1.619 1.637	7½	Floats in No. 4. Sinks in No. 5. From ruby and topaz, by R. and S. G. Looks a little browner at night.	
	KUNZITE	(Gp.) SPODUMENE.	3.17—3.20	Distinct.	1.651 1.677	6½-7	Floats in No. 4. Sinks in No. 5. From tourmaline and topaz, by R. and S. G.	

Color.	Jeweler's name.	Mineralogical name, where different.	Specific gravity.	Dichroism.	Refractive power.	Hardness.	Easiest tests.
RED	RUBY and ARTIFICIAL RUBY	(Gp.) CORUNDUM.	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1. Artificial ruby contains often the appearance of dust in layers. Lines in natural ruby always straight. Lines in artificial ruby always curved. Bubbles in natural ruby more or less angular. Bubbles in artificial ruby oval or round. Silk in natural ruby often shows crystalline formation.
	SIAM RUBY	(Gp.) CORUNDUM.	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1.
	SPINEL		3.60—3.63	None.	1.716 to 1.730	8	Floats in No. 2. Sinks in No. 3. Lack of D. from ruby; also by R. from garnet.
	TOURMALINE		3.1	Strong.	1.619 1.637 to 1.637 1.655	7-7½	Floats in No. 4. Sinks in No. 5. From ruby by H., S. G. and R. From garnet by D.
	JARGOON	(Var.) HYACINTH (Group) ZIRCON	4.65—4.70	V.faint.	1.931 1.993	7½	Sinks in No. 1. (Image, see colorless.)
	JACINTH	(Group) GARNET... (Variety) HESSONITE or CINNAMON STONE	3.55—3.65	None.	1.744 to 1.748	7-7½	Floats in No. 2. Sinks in No. 3. Transmitted daylight in jacinth is yellowish. Transmitted daylight in garnet is reddish. Jacinth has often irregular bubbles and sandy grains.
	GARNET	(Var.) PYROPE	3.70—3.80	None.	1.740 to 1.770	7-7½	Floats in No. 1. Sinks in No. 2. From spinel by H. and S. G. From ruby and tourmaline by lack of D.
COLORLESS	DIAMOND	3.52—3.53	None.	2.417	10		Floats in No. 3. Sinks in No. 4. By H.
	JARGOON	ZIRCON	4.68—4.75	None.	1.923 1.967 to 1.931 1.993	7½	Sinks in No. 1. Considerable play of color similar to diamond. Very heavy. Shows distinct double image of candle flame if seen through colorless and most colored varieties with eye close to table.
	SAPPHIRE	(Group) CORUNDUM	3.97—4.05	None.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1. By S. G. and H.
	TOPAZ (Braz.)		3.0—3.	None.	1.615 1.625 to 1.629 1.637	8	Just floats or sinks in No. 3. By S. G. and R.
	AQUAMARINE	(Group) BERYL	2.69—2.70	None.	1.576 1.582	7½-8	Floats in No. 5. Sinks in No. 6. From topaz and quartz, by R. S. G. a little more than quartz. Shows nearly always a tint of blue if held in fold of white paper.
	PHENAKITE		2.97—3.0	None.	1.654 1.670	7½-8	Just floats or sinks in No. 5. By S. G. and R.
	TOURMALINE	Also ACHROITE	3.0	None.	1.619 1.637	7-7½	Floats in No. 4. Sinks in No. 5. By R.
	BERYLLONITE		2.84	None.	1.552 1.561	5½-6	Floats in No. 5. Sinks in No. 6. By H.
	ROCK CRYSTAL	QUARTZ	2.65	None.	1.544 1.553	7	Floats in No. 6. By S. G. and R.

The colorless varieties usually seen are Diamond Sapphire, Topaz, Quartz, and sometimes Jargoon.
Refractometer especially useful with colorless stones.

Color.	Jeweler's name.	Mineralogical name, where different.	Specific gravity.	Dichroism.	Refractive power.	Hardness.	Easiest tests.
YELLOW (See also Tourmaline)	SPHENE	Also TITANITE	3.35—3.45	Distinct.	1.888 1.979	5½	Floats in No. 3. Sinks in No. 4. By H. If clear and well cut has much play of color. R. I. of darker yellow colors 1.913 and 2.054.
	JARGOON	ZIRCON	4.30—4.63	Faint.	1.923 1.967 to 1.931 1.993	7½	Sinks in No. 1. By S. G. (See colorless.) Gives double image.
	JACINTH	(Gp.) GARNET.. (Var.) HESSONITE	3.55—3.65	None.	1.744 to 1.770	7-7½	Floats in No. 2. Sinks in No. 3. By S. G. from quartz. By S. G. from topaz, and also lack of D.
	CASSITERITE		7.0	Faint.	2.00 2.09	6½	Sinks in No. 1. Heaviest precious stone. Softer than jargoon. Nearly always very small if clear.
	SAPPHIRE	(Gp.) CORUNDUM (Var.) ORIENTAL TOPAZ.	3.97—4.05	Faint.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. A few sink slowly in No. 1. Generally a straw tint. From chrysolite by H. and S. G.
	BRAZ. TOPAZ		3.50—3.56	Distinct.	1.615 1.625 to 1.629 1.637	8	Floats in No. 3. Sinks in No. 4. By S. G., H. and R. from sapphire and quartz.
	SCOTCH TOPAZ	(Gp.) QUARTZ (Var.) CITRINE	2.65	Faint.	1.544 1.553	7	Floats or sinks slowly in No. 6. From beryl, sapphire and jacinth, by S. G., H. and R.
	CHRYSOBERYL or CHRYSOLITE	CHRYSOBERYL	3.65—3.78	Distinct.	1.747 1.756	8½	Floats in No. 1. Sinks in No. 2. From sapphire by S. G. and H.
	YEL. PERIDOT	CHRYSOLITE	3.3—3.5	Faint.	1.663 1.701	6½-7	Floats in No. 3. Sinks slowly in No. 4. By S. G. and R.
	SPODUMENE		3.17—3.20	Distinct.	1.651 1.677	6½-7	Floats in No. 4. Sinks in No. 5. By S. G. and R.
	YELLOW AQUAMARINE or BERYL		2.69—2.70	Faint.	1.576 1.582	7½-8	Floats in No. 5. Sinks in No. 6. From peridot and spodumene by S. G. and R.
PURPLE	SAPPHIRE	(Gp.) CORUNDUM (Var.) ORIENTAL. AMETHYST	3.97—4.05	Strong.	1.759 1.769	9	Floats in No. 1. Sinks in No. 2. By H. and strong D. A few sink slowly in No. 1.
	SPINEL		3.60—3.63	None.	1.730	8	Floats in No. 2. Sinks in No. 3. Lack of D. By S. G. and R. from garnet.
	GARNET (ALMANDINE)		4.1—4.3	None.	1.770 to 1.810	7½	Sinks in No. 1. Lack of D. From spinel by S. G.
	AMETHYST		2.65	Distinct.	1.544 1.553	7	Floats in No. 6. By S. G. H. and R. from sapphire.
	KUNZITE	(Gp.) SPODUMENE.	3.17—3.20	Distinct.	1.651 1.677	6½-7	Floats in No. 4. Sinks in No. 5. S. G., H. and R. from sapphire. S. G. from amethyst.

Color.	*Jeweler's name.*	*Mineralogical name, where different.*	*Specific gravity.*	*Dichroism.*	*Refractive power.*	*Hardness.*	*Easiest tests.*
	ORIENTAL CATSEYE	CHRYSOBERYL or CYMOPHANE	3.68—3.84	....	....	8½	Floats in No. 1. Sinks in No. 2. Ray generally brighter than quartz. By S. G. and H.
	QUARTZ CATSEYE		2.65	....	....	7	Floats in No. 6.
	CROCIDOLITE CATSEYE		2.65	....	....	7	Floats in No. 6.
	HUNGARIAN CATSEYE		2.65	....	....	7	Floats in No. 6.
	SHELL or CHINESE CATSEYE		2.65—2.68	....	....	4-4½	Floats in No. 6, or sinks slowly. Is scratched by a knife. Hydrochloric acid on surface effervesces.
	CORAL		2.6—2.7	....	....	5	Floats in No. 6, or sinks slowly. Coral effervesces actively with hydrochloric acid, ivory and bone slightly. In coraline, or stained coral the color is skin deep.
	PINK PEARL		2.84—2.89	....	....	4½	Floats in No. 5. Sinks in No. 6. By S. G. from coral.
	PEARL		2.65—2.68	....	....	4	Just floats or sinks in No. 6. For S. G. if drilled remove air from hole. If scraped by knife gives off powder. A spot of ink on those having glass surface is reflected on inner surface. Usually holes in pastes have rounded edges. Some pastes have a coating of wax on glass, easily peeled.
	OPAL		2.1—2.2	None.	1.450	5½-6	Floats in No. 6. Glass imitations much heavier. Fire marble similar to opal matrix, is scratched by a knife.

A file scratches the backs of most doublets, and dull reflection from join can be seen. If made in two pieces of quartz and coloring matter introduced between, can be detected if placed in cold water. Triplets are also detected thus. Warm water separates the parts. Many characteristics can be seen by closely examining the specimens with a powerful magnifying glass. Good sharp knife = No. 6 in scale of hardness; good file or quartz = No. 7; topaz = No. 8; sapphire = No. 9; diamond = No. 10. The rarer species are printed above in lighter type.

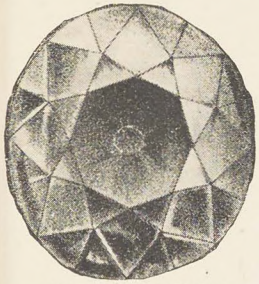
In the easiest tests the names are those generally used by jewelers.
Ceylon sapphires are a little harder than Cashmere, and Montana a little softer than Burmah sapphires.
Toluene and Benzene are highly inflammable. Toluene if left exposed in scales will injure steel parts.
If dichroism cannot be seen at once try several different directions before finally deciding.
S. G. = Specific Gravity. R. = Refractivity. D. = Dichroism. H. = Hardness. Var. = Variety. Gp. = Group.

Miscellaneous.

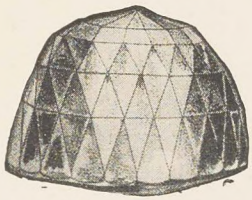
Famous Diamonds of the World.

Name.	*Weight. (Uncut) Carats.*	*Color.*	*Where from.*	*Shape.*	*Owner.*
Cullinan.	3,032	.....	Premier Mine.	Parallelepipedon.	.....
Jagersfontein Excelsior.	239	Blue White.	Orange Free State.	Broken Icicle.	Cut up into small stones.
Jubilee.	....	.....	Orange Free State.	.....	.....
Koh-i-Noor.	102 1-16	White.	Mine of Gani.	Oval.	British Crown.
Regent or Pitt.	136 3-4	.....	Golconda.	Square.	French Crown.
Star of the South or Halphen.	125	.....	Brazil.	Oval.	Mr. Coster, Amsterdam.
The Hope.	44 1-2	Blue.	.....	Oval.	.....
The Sancy.	53 1-2	.....	.....	Almond.	.....
The Shah.	86	White.	.....	Hexagonal.	Czar of Russia.
The Mattam.	367	White.	Borneo.	Pear.	Rajah of Mattam.
The Nassak.	78 5-8	.....	.....	Triangular.	Marquis of Westminster.
The Orloff.	194 1-2	.....	.....	Oval.	Czar of Russia.
The Pigott.	82 1-4	.....	.....	Rose.	Czar of Russia.
The Florentine.	139 1-2	Yellow.	.....	Rose.	Emperor of Austria.
Imperial or Victoria.	180	.....	Kimberly Mines.	Uneven Oval.	Anglo-French Syndicate.
Cumberland.	32	.....	.....	Circular.	British Crown.
Polar Star.	40	White.	.....	Hexagonal.	Princess Yassopouff.
Eugenie.	51	.....	.....	Oval.	French Crown.
Pasha of Egypt.	40	.....	.....	Octagonal.	Ibraham, Viceroy of Egypt.
Dresden Green.	76 1-2	White.	Brazil.	Octagonal.	.....
Star of South Africa.	83 1-2	.....	South Africa.	Drop.	.....
Great Mogul.	279	.....	India.	Dome.	Cut up into small stones.
Sea of Light.	186	.....	.....	.....	Shah of Persia.
Crown of the Moon.	146	.....	.....	.....	Shah of Persia.

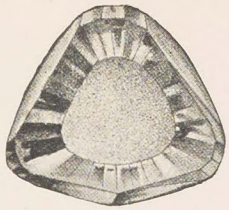
Some Famous Diamonds.



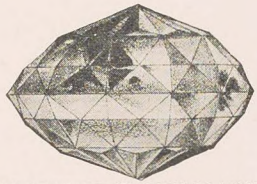
THE KOH-I-NOOR.



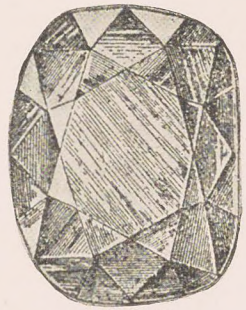
THE ORLOFF.



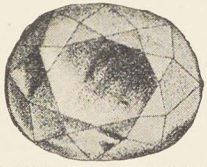
THE NASSAC.



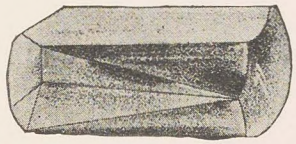
FLORENTINE BRILLIANT.



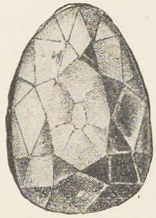
IMPERIAL.



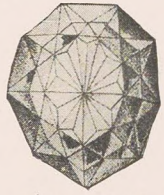
EUGENIE BRILLIANT.



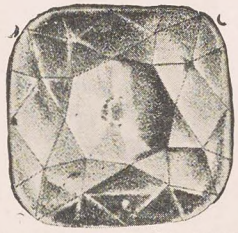
THE SHAH.



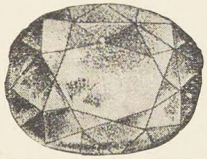
DRESDEN GREEN.



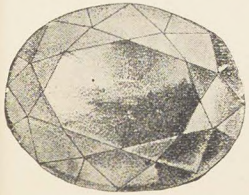
THE SANCY.



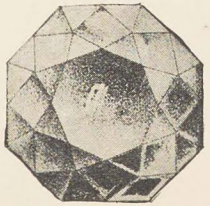
THE REGENT OR PITT.



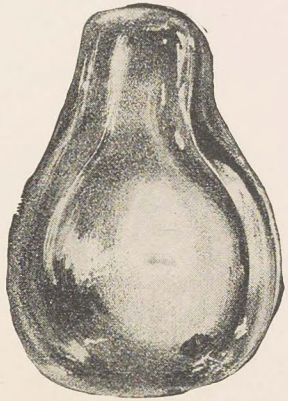
THE HOPE BLUE DIAMOND.



THE PIGOTT.

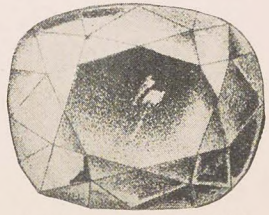


THE POLAR STAR.



THE MATTAM.

THE CUMBERLAND.



STAR OF THE SOUTH.

Poetry of Gems.

The poem to correspond with the lithomancy as agreed upon by various authorities and generally used, is as follows:

JANUARY.

By her who in this month is born,
No gem save onyx should be worn;
It will insure her constancy,
True friendship and fidelity.

FEBRUARY.

The February-born will find
Sincerity and peace of mind,
Freedom from passion and from care
If they the jasper will wear.

MARCH.

Who in this world of ours their eyes
In March first open shall be wise.
In days of peril firm and brave,
And wear a ruby to their grave.

APRIL.

She who from April dates her years
Topaz should wear, lest bitter tears
For vain repentance flow; this stone
Emblem of innocence is known.

MAY.

Who first beholds the light of day
In Spring's sweet flowery month of May,
And wears a carbuncle all her life,
Shall be a loved and happy wife.

JUNE.

Who comes with Summer to this earth,
And owes to June her day of birth,
With ring of emerald on her hand
Can health, wealth and long life command.

JULY.

The glowing sapphire should adorn
Those who in warm July are born;
Then will they be exempt and free
From love's doubts and anxiety.

AUGUST.

Wear a diamond, or for thee
No conjugal felicity;
The August-born without this stone,
'Tis said, must live unloved and alone.

SEPTEMBER.

A maiden born when Autumn leaves
Are rustling in September's breezes,
A jacinth on her brow should bind—
'Twill cure diseases of the mind.

OCTOBER.

October's child is born for woe,
And life's vicissitudes must know;
But lay the agate on her breast,
And hope will lull those woes to rest.

NOVEMBER.

Who first comes to the world below
With drear November's fog and snow
Should prize the amethyst's purple hue,
Emblem of friends and lover true.

DECEMBER.

If cold December gave you birth,
The month of snow, and ice, and mirth,
Place on your hand a beryl true,
Success will crown whate'er you do.

Another poet rhymes the gems of the various months in this way:

Let January's maiden be
All Garnet gemed with constancy.

In fitful February it's a verity
The Amethyst denotes sincerity.

What, oh what, shall a March maid do?
Wear a Bloodstone and be firm and true.

The April girl has a brave defense,
The Diamond guards her innocence.

Sweet child of May, you'll taste the caress
Of the Emerald's promised happiness.

Pearls for the girls of June—precious wealth,
And to crown it all they bring her health.

The Ruby stole a spark from heaven above,
To bring the July maiden fervent love.

The August maiden with sweet simplicity,
Wears Sardonyx gem of felicity.

Out of the depths shall Sapphires come,
Bringing September's child wisdom.

October's child in darkness oft may grope,
The iridescent Opal bids it hope.

Born in November, happy is she,
Whom the Topaz teaches fidelity.

December's child shall live to bless,
The Turquoise that insured success.

Birth Month Stones According to Various Nations.

	Jews.	*Romans.*	635 *A. D., Isidorus Bishop of Seville.*	*Arabians.*	*Poles.*	*Russians.*	*Italians.*	18*th and* 19*th Centuries.*
January	Garnet.	Garnet.	Hyacinth.	Garnet.	Garnet.	Garnet, or Hyacinth.	Jacinth, or Garnet.	Garnet.
February	Amethyst.	Amethyst.	Amethyst.	Amethyst.	Amethyst.	Amethyst.	Amethyst.	Amethyst, or Pearl.
March	Jasper.	Bloodstone.	Jasper.	Bloodstone.	Bloodstone.	Jasper.	Jasper.	Jasper, Hyacinth, or Amethyst.
April	Sapphire.	Sapphire.	Sapphire.	Sapphire.	Diamond.	Sapphire.	Sapphire.	Sapphire, or Diamond.
May	Chalcedony, Carnelian, or Agate.	Agate.	Agate.	Emerald.	Emerald.	Emerald.	Agate.	Agate.
June	Emerald.	Emerald.	Emerald.	Agate, or Chalcedony.	Agate, or Chalcedony.	Agate, or Chalcedony.	Emerald.	Emerald, Cat's-eye, Turquoise, Onyx.
July	Onyx.	Onyx.	Onyx.	Carnelian.	Ruby.	Ruby and Sardonyx.	Onyx.	Onyx.
August	Carnelian.	Carnelian.	Carnelian.	Sardonyx.	Sardonyx.	Alexandrite.	Carnelian.	Sardonyx, Moonstone, Topaz.
September ...	Chrysolite.	Sardonyx.	Chrysolite.	Chrysolite.	Sardonyx.	Chrysolite.	Chrysolite.	Chrysolite, Topaz, or Diamond.
October	Aquamarine, or Beryl.	Aquamarine, or Beryl.	Aquamarine, or Beryl.	Aquamarine, or Beryl.	Aquamarine, or Beryl.	Beryl.	Beryl.	Opal, or Sapphire.
November	Topaz.	Topaz.	Topaz.	Topaz.	Topaz.	Topaz.	Topaz.	Topaz, or Pearl.
December ...	Ruby.	Ruby.	Ruby.	Ruby.	Turquoise.	Turquoise, Chrysoprase.	Ruby.	Ruby, Bloodstone.

Gems for the Days of the Week.

The proper stones for rings to be worn on certain days of the week are as follows:

Sunday.—Gold or yellow topaz.
Monday.—Pearls or white topaz.
Tuesday.—Ruby or garnet.
Wednesday.—Sapphire or turquoise.
Thursday.—Amethyst.
Friday.—Emerald.
Saturday.—Diamond.

Gems and their Significance.

Month.	*Gem.*	*Significance.*	*Zodiacal sign.*
January	Garnet	Constancy and Fidelity	The Water Bearer.
February	Amethyst or Pearl	Sincerity	The Fishes.
March	Bloodstone	Courage, Presence of Mind	The Ram.
April	Diamond	Innocence	The Bull.
May	Emerald	Success in Love	The Twins.
June	Agate, Cat's-Eye or Pearl	Health and Long Life	The Crab.
July	Coral or Ruby	Contented Mind	The Lion.
August	Sardonyx or Moonstone	Conjugal Felicity	The Virgin.
September	Chrysolite or Sapphire	Antidote against Madness	The Balance.
October	Opal	Hope	The Scorpion.
November	Topaz	Fidelity	The Archer.
December	Turquoise	Prosperity, Truth	The Goat.
	Hyacinth	Victory, Health.	
	Jasper	Protection against Evil.	
	Onyx	Reciprocal Love.	
	Chrysolite	Wisdom.	
	Jet	Sad Remembrance.	
	Moss Agate	Living Death.	

Significance of Gems.

Different gems used for settings in rings have had all sorts of virtues and powers attributed to them. Among the most universal are, perhaps:

Emerald.—For insuring purity of thought.

Sapphire.—Cooling; used for priests' rings, to show their coolness for worldly pleasures.

Carbuncle.—For preserving health and repressing luxury.

Turquoise.—Indicates the presence of poison or illness by changing color.

Gold.—Cures St. Anthony.

Jet.—Drives away serpents.

Garnet; fidelity in every engagement.

Pearl; peace of mind. Regarded by the ancients as having power to dispel drunkenness.

Bloodstone; I mourn your absence, or sorrow for absent ones.

Diamond; pride. Has power of making men courageous and magnanimous. Protects from evil spirits. Maintains concord between husband and wife, and for this reason was regarded as most appropriate for the engagement ring.

Emerald; success in love.

Ruby; cheerfulness. An amulet against poison, sadness and evil thoughts. A preservative of health.

Sapphire; chastity. Procures favor with princes.

Opal; fidelity. Calms the passions.

Turquoise; success and happiness. Preserves from contagion.

Birthday Flowers.

JANUARY.

Crocus—Youthfulness.

Contented to live, yet not fearful to die,
With a conscience unspotted, I pass thro' life's scene
That the end of my days be resigned and serene.

FEBRUARY.

Fern—Sincerity.

Lives of great men all remind us,
We can make our lives sublime,
And, departing, leave behind us
Footsteps on the sands of time.

MARCH.

Pansy—Thought.

Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labor and to wait.

APRIL.

Daisy—Innocence.

'Twas when the world was in its prime,
When meadows green and woodlands wild
Were strewn with flowers in sweet spring-time,
And everywhere the daisies smiled.

MAY.

Olive Branch—Peace.

Dear friend, to you this olive spray
I send, the messenger of love;
It speaks a sentiment above
All other language to convey.

JUNE.

Corn—Riches.

Thou land of milk and honey,
Land of corn and oil and wine,
How longs my hungry spirit to
Enjoy thy food divine.

JULY.

Cowslip—Pensiveness.

The cowslips tall her pensioners be;
In their gold coats spots you see;
Those be rubied, fairy clowers,
In their freckles live their savours.

AUGUST.

Woodbine—Devoted Affection.

My cottage with woodbine o'ergrown
The sweet turtle doves coo around;
My flocks and my herd are my own,
And my pastures with hawthornes are bound.

SEPTEMBER.

Oak—Hospitality.

O flourish, hidden deep in ferns,
Old oak, I love thee well.
A thousand thanks for what I learn.

OCTOBER.

Rose—Beauty.

When all the world in sleep reposes,
In the coach that's curtained round with roses,
Fair goddess with heart searching eyes,
In thy gold, dove-drawn car descend.

NOVEMBER.

Moss—Maternal Love.

Kind mother earth, who all receives,
Will yield unchanged her sacred trust,
While angels lead thee to the throne.

DECEMBER.

Forget-me-not.

Onward and onward moments fly,
My sands of life make haste to run;
Lord, grant me favor ere I die
To leave no appointed task undone.

Zodiacal Signs of Flowers.

Mistletoe	Aquarium (the waterman)
Pine Needles	Pisces (the fishes)
Daffodil	Aries (the ram)
Dandelion	Taurus (the bull)
Wild Rose	Cancer (the crab)
Pond Lily	Leo (the lion)
Poppy	Virgo (the virgin)
Maple Leaf	Scorpio (the scorpion)
Indian Corn	Libra (the balance)
Chrysanthemum	Sagittarius (the archer)
Holly	Capricornus (the goat)
Iris	Gemini (the twins)

Wedding Anniversaries.

First year	Cotton
Second year	Paper
Third year	Leather
Fifth year	Wooden
Seventh year	Woolen
Tenth year	Tin
Twelfth year	Silk or Fine Linen
Fifteenth year	Crystal
Twentieth year	China
Twenty-fifth year	Silver
Thirtieth year	Pearl
Fortieth year	Ruby
Fiftieth year	Golden
Seventy-fifth year	Diamond

Flowers.

The following shows five different lists of the flowers of the month, taken from various authorities:

January	Mistletoe	Crocus	Snow Drop	Snow Drop	Wild Rose.
February	Pine Needles	Fern	Primrose	Pink	Pink.
March	Daffodil	Pansy	Ipomoea, Violet	Violet	Violet.
April	Dandelion	Daisy	Daisy	Easter Lily	Easter Lily
May	Iris	Olive Branch	Hawthorn	Lily of the Valley	Lily of the Valley.
June	Wild Rose	Corn	Honeysuckle	Rose	Rose.
July	Pond Lily	Cowslip	Water Lily	Daisy	Daisy.
August	Poppy	Woodbine	Poppy	Water Lily	Pond Lily.
September	Indian Corn	Oak	Morning Glory	Poppy	Poppy.
October	Maple Leaf	Rose	Hops	Cosmus	Cosmus.
November	Chrysanthemum	Moss	Chrysanthemum	Chrysanthemum	Chrysanthemum
December	Holly	Forget-Me-Not	Holly	Holly	Holly.

Official Flowers of the United States.

Alabama	Golden Rod	Maine	Pine Corn and Tassel*	Oregon	Oregon Grape
Arkansas	Apple Blossom*	Michigan	Apple Blossom	Pennsylvania	Golden Rod
California	Eschscholtzia*	Minnesota	Moccasin	Rhode Island	Violet
Colorado	Columbine	Mississippi	Magnolia	South Carolina	Golden Rod
Delaware	Peach Blossom	Missouri	Golden Rod	South Dakota	Anemone
Idaho	Syringa	Montana	Bitter Root*	Texas	Blue Bonnet*
Indiana	Corn	Nebraska	Golden Rod	Utah	Sego Lily
Iowa	Sunflower	New York	Rose	Vermont	Red Clover*
Kansas	Sunflower*	North Dakota	Wild Rose	Washington	Rhododendron
Kentucky	Golden Rod	Ohio	Golden Rod	West Virginia	Rhododendron
Louisiana	Magnolia	Oklahoma	Mistletote		

Those marked with a * were adopted by their State Legislatures. All others were adopted by vote of public school scholars in each State.